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**The role of daily autonomous and controlled educational goals
in students' academic emotion states:
An experience sampling method approach**

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Abstract

The present study examines antecedents of university students' academic emotions (Pekrun, Goetz, Titz, & Perry, 2002) in the context of self-determination theory (SDT; Deci & Ryan, 1985; 2000), using real-time assessment and intra-individual analyses. We investigated whether daily autonomous and controlled-motivated educational goals predicted students' academic emotions. University students (N=55) completed smartphone diaries over 14 consecutive days. The two-week intensive longitudinal data were organized in a hierarchical three-level structure, with situations (Level 1) nested within days (Level 2) nested within students (Level 3). Students' goal motivation was assessed in morning questionnaires, and academic emotions in three daytime questionnaires. The results of the multilevel structural equation models showed that setting self-determined autonomous educational goals predicted positive emotions, whereas controlled motivation predicted negative emotions in everyday academic situations, applying both to within-person processes and between-person differences. Both kinds of goal motivation, autonomous and controlled, were associated with determination in students' daily lives.

Keywords: Academic emotions, Educational goals, Autonomous and controlled motivation, Self-determination theory, Experience sampling method

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1. Introduction

Previous research suggests that emotional experiences in educational settings strongly influence students' learning, achievement, and long-term academic development, and form part of their well-being (e.g., Linnenbrink, 2006; Pekrun & Linnenbrink-Garcia, 2014; Schutz, Hong, Cross, & Osbon, 2006). Little is known, however, about the relation of short-term educational goal pursuit to academic emotions. According to self-determination theory (SDT; Deci & Ryan, 1985; 2000), the reasons for why people pursue their goals have an impact on their experiences, even beyond the content of their goals (Deci & Ryan, 2000; Sheldon & Elliot, 1999). The theory suggests that pursuing goals for intrinsic reasons might be more likely to evoke positive emotions than carrying out tasks motivated by external pressure. Furthermore, the emotions students experience in educational settings are influenced by personal characteristics and situational influences (Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013; Moeller, Dietrich, Eccles, & Schneider, 2017; Moeller, Salmela-Aro, Lavonen, & Schneider, 2015).

The present study uses an experience sampling method (ESM) to examine the extent to which university students' academic emotions vary from one learning situation to another, from one day to another, and from one individual to another. Two-week intensive longitudinal data were collected using smartphones, four times per day, including weekends. The main purpose of this study was to investigate whether self-determined, short-term educational goal pursuit was related to situational academic emotions. More specifically, we examined whether setting either autonomous or controlled-motivated educational goals in the morning would

predict students' emotional states during the day. Following an intra-individual approach, we investigated whether this association would replicate both at the between-day level and the between-student level (i.e., inter-individual association).

1.1. Academic emotions

Emotions that are linked to learning, instruction, and achievement within educational settings are called academic emotions (Pekrun, Goetz, Titz, & Perry, 2002). Two types of academic emotions with different object focuses can be distinguished: *outcome emotions* pertaining to the outcomes of activities (e.g., hope for success or shame from failure), and *activity emotions* pertaining to an ongoing academic task (e.g., enjoyment during learning). These emotions can be further characterized based on their *positive* or *negative* valence (i.e., whether the emotional state is pleasant or unpleasant) and *activating* or *deactivating* nature (i.e., whether the emotional state includes high arousal or is passive; Pekrun, 2006; Pekrun, 2016). In contrast to deactivating emotions, which are assumed to be detrimental to academic motivation and cognitive performance (such as relaxation and boredom), positive (pleasant) activating emotions in particular have been shown to enhance students' performance. For instance, the enjoyment of learning has been found to be related to increased interest, effort, self-regulation and elaboration of the learning material, thus likely facilitating overall performance (Pekrun & Linnenbrink-Garcia, 2014). The underlying patterns of negative (unpleasant) activating emotions may be more complex. For instance, anxiety has been shown to produce task-irrelevant thinking in some situations, thus reducing the cognitive resources available for task purposes. However, it may also induce the motivation to study harder and thus facilitate overall learning in those who are more resilient to the devastating aspects of anxiety (Pekrun, 2016; Pekrun et al., 2002; for the difference between motivating and inhibiting anxiety, see Jones, Meijen, McCarthy, & Sheffield, 2009; Moeller et al., 2015).

In the academic context, emotions are often studied with large samples at one point in time, with a focus on individual differences (e.g., Lonka & Ketonen, 2012). However, these

trait-like conceptualizations and assessments have been criticized because they may reflect overall cognitive schemas and beliefs about academic emotions rather than actual experiences, and may be confounded with recall bias and distortion (see Goetz et al., 2013). In addition, they do not capture the effect of situational determinants and emotional fluctuations over time. Consequently, an increasing number of studies measure academic emotions with real-time assessments (e.g., Ahmed, Werf, Minnaert, & Kuyper, 2010; Bieg, Goetz, & Hubbard, 2013; Goetz, Frenzel, Stoeger, & Hall, 2010; Goetz, Sticca, Pekrun, Murayama, & Elliot, 2016; Moeller et al., 2015; Nett, Goetz, & Hall, 2011; Tanaka & Murayama, 2014).

Previous studies using situational (intra-individual) approaches to examine academic emotions indicate that the majority of the variance in emotions occurs between different learning situations rather than being driven by personal dispositions (Goetz et al., 2016; Nett et al., 2011; Tanaka & Murayama, 2014). However, in the aforementioned studies, the amount of variance due to changes in academic emotions *between days* was not reported or compared to the situational variance *within days*, although some studies suggest that students may have distinctly different moods or emotional states depending on the day (see Harvey et al., 2015; Litmanen, Lonka, Inkinen, Lipponen, & Hakkarainen, 2012; Tolvanen et al., 2011). Research examining within-person variations across the days of week in general life emotions has reported meaningful variance in emotions between days (see Hawkey, Preacher, & Cacioppo, 2007; Nezlek, Vansteelandt, Van Mechelen, & Kuppens, 2008) and has provided evidence of positive weekend effects and negative back-to-work/school effects, for instance (e.g., Ryan, Bernstein, & Brown, 2010).

Emotions can be measured as fluctuating states or as stable trait dispositions (Pekrun, 2006). The concept of dispositional affect suggests that people are predisposed to experience certain types or groups of emotions (e.g., Watson, Clark, & Tellegen, 1988). For instance, some people experience positive emotions more often than others (e.g., Lucas & Fujita, 2000; Watson & Clark, 1992). Situational emotions are related to stable affective dispositions in

different ways. For example, situational emotions may repeat across situations and form a stable pattern: individuals who *often* feel pleasant emotions also tend to be satisfied with their lives as a whole (Lucas, Diener, & Suh, 1996; Watson et al., 1988). On the other hand, rather stable affective patterns such as moods or depressive episodes may influence the likelihood and consequences of situational emotions (Hirt, McDonald, Melton, & Harackiewicz, 1996; Lane, Whyte, Terry, & Nevill, 2005).

Besides the differences in situational, daily, and individual fluctuation, emotions may also co-occur or ‘blend’ differently depending on the time frame (Schmukle, Egloff, & Burns, 2002; Vansteelandt, Van Mechelen, & Nezlek, 2005). For example, individuals who are prone to feeling nervous are also prone to feeling angry (e.g., Watson et al., 1988). In contrast, when a person is angry at a particular moment, he or she does not necessarily feel guilty or anxious. In previous studies, measures of momentary affect, for instance, showed lower correlations between emotions of the same valence than measures of affect that captured longer time periods (e.g., state versus trait correlations, see Goetz et al., 2016; Vansteelandt et al., 2005). Although research assessing academic emotions with intra-individual approach and real-time assessments is increasing, the empirical evidence on intra-individual antecedents of students’ emotions is restricted to only a few studies (see Ahmed et al., 2010; Bieg et al., 2013; Goetz et al., 2010; Goetz et al., 2016; Tanaka & Murayama, 2014). Furthermore, little is known about the short-term effects of education-related personal goals on situational academic emotions.

1.2. Autonomous and controlled motivation in educational goal pursuit

Personal goals are subjectively meaningful aspirations that individuals actively pursue in their daily lives (Little 1983; Salmela-Aro, 2009). A personal goal framework has also been applied in the academic context, suggesting that education-related personal goals and cognitive appraisals of these goals are related to students’ academic achievement, attainment, and well-being (e.g., Dietrich & Salmela-Aro, 2013; Salmela-Aro, Mutanen, Koivisto, &

Vuori, 2010; Salmela-Aro & Nurmi, 1997; Vasalampi, Salmela-Aro, & Nurmi, 2010). Typical appraisals include value, expectancy, or temporal range (Austin & Vancouver, 1996). In the present study, we focus on the value dimension, because value is assumed to be one major antecedent of academic emotions (Pekrun, 2006).

SDT (Deci & Ryan, 2000; Sheldon & Elliot, 1999) describes two types of value-related appraisals: autonomous and controlled goal motivation. Autonomously motivated goals or activities are self-initiated and freely chosen, and thus well aligned with the individual's personality and inner needs (Sheldon & Elliot, 1999). Controlled motivation, in contrast, means that a goal is pursued for external rewards or to avoid guilt, shame, or anxiety (Deci & Ryan, 2000). Previous studies on university students have revealed that in a variety of life domains, pursuing autonomous goals is associated with greater well-being and related negatively to various indicators of ill-being, such as depressive symptoms, negative affect, and physical symptoms (e.g., Schmuck, Kasser, & Ryan, 2000; Sheldon, Ryan, Deci, & Kasser, 2004). In educational contexts, autonomous motivation has been shown to be positively correlated with university students' life satisfaction and self-esteem (e.g., Levesque, Zuehlke, Stanek, & Ryan, 2004), positive affect and vitality (e.g., Miquelon & Vallerand, 2006; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000), enjoyment and interest, and decreased anxiety (Black & Deci, 2000). Furthermore, experimental findings by Gillet, Vallerand, Lafreniere, and Bureau (2013) indicate that university students' autonomous motivation predicts positive affect, while controlled motivation leads to negative affect during a heuristic task. However, controlled-motivated goals also have some positive effects; namely, they lead to higher persistence over the short term than not pursuing any goal (Vansteenkiste, Lens, & Deci, 2006). Theoretically, it has been suggested that controlled forms of motivation can elicit desired behaviour, at least in the short term, and that negative behavioural repercussions may manifest over an extended period (Deci & Ryan, 2000).

While the above-described studies identified relationships of goal-based behaviour across individuals, in the present study the aim was to also to identify the relationships of behaviour within a given individual. Previous research using intra-individual analyses indicates that high value appraisals during educational tasks are related to students' positive and negative emotions (Ahmed et al., 2010; Bieg et al., 2013; Goetz et al., 2010). Subjectively important task outcomes were found to lead to stronger positive and negative emotions, compared to tasks that are perceived as less valuable and important (see also Pekrun, 2006). Positive correlations between values and positive emotions were found consistently across many studies using intra-individual approach (Ahmed et al., 2010; Bieg et al., 2013; Goetz et al., 2010). However, the correlation between value and negative emotions has been found to be both positive (Bieg et al., 2013) and negative (Ahmed et al., 2010). SDT may help to explain the different ways in which values relate to negative emotions. First of all, students may see value in putting effort into the activity in order to meet others' expectations, or they may see personal value and relevance in pursuing an educational goal. In fact, the incentive value of a particular goal (e.g., finding a job) has been found to correlate equally with autonomous and controlled motivation (Vansteenkiste, Lens, Witte, & Feather, 2005). Thus, since in the first case the basis for motivation is controlled, more negative emotions may follow, whereas the second case describes an autonomously motivated situation, and therefore, the activity is also presumably associated with fewer negative emotions (Deci & Ryan, 2000). Thus, instead of just considering whether one values the activity or not (i.e., the amount of motivation), the quality or type of motivation as proposed by SDT may define whether the emotional experience is more positive or negative.

Despite the number of studies on the relation between autonomous motivation and well-being in academic settings, it remains unknown to what extent these findings can be generalized to the level of situations and within-person functioning. Moreover, goals may have a different temporal focus (e.g., Austin & Vancouver, 1996) – some are pursued over

years, while others are set to complete a specific task (such as writing an essay). It is thus worthwhile to study educational goals on different temporal levels. Given that much of the existing research focuses on more long-term educational goals, there is a paucity of knowledge on short-term goal processes operating within students. By applying SDT (Deci & Ryan, 1985; 2000) and a personal goal framework (e.g., Dietrich & Salmela-Aro, 2013), the present study explores the antecedents of university students' academic emotion states, analysing both intra- and inter-individual variation.

1.3. The present study

This study assessed students' state emotions and short-term academic goal motivation in real-life settings with multiple assessments within each student. For this purpose, university students completed smartphone diaries over 14 consecutive days. Every morning, the students were asked to report three personal educational goals for the day and the extent to which they pursued each goal for autonomous and controlled reasons. Later during the day, the students were asked at three times to rate their emotional states. This short-term intensive longitudinal design results in hierarchically nested data with situations nested within days nested within students. Analysing these nested data with a multilevel approach enabled us to 1) investigate the extent to which university students' intra-individual emotions varied in real-time situations (i.e., from one studying situation to another and from one day to another), 2) investigate whether setting autonomous or controlled-motivated educational goals in the morning predicted students' emotional states during the day, and 3) compare this to between student patterns (i.e., inter-individual association). In our analyses of the student level, we also controlled for the influence of two trait measures in the additional models: the extent to which students exhibit depressive symptoms and life satisfaction. The research questions (RQ) were as follows:

RQ1: Do academic emotions vary within students from one situation to another and from one day to another (i.e., variation within a day and between days)?

Based on previous intra-individual research on academic emotions (Goetz et al., 2016; Nett et al., 2011; Tanaka & Murayama, 2014), we assumed that academic emotions experienced during study-related activities would show intra-individual fluctuation. More specifically, on the situation level (within-day level), we expected substantive variation in both positive and negative activating emotions (Hypothesis 1a), in line with previous studies in which the situational variation of academic emotions has been found to be larger than the between-person variation (Goetz et al., 2016; Nett et al., 2011; Tanaka & Murayama, 2014). Furthermore, we hypothesized the between-day variance of academic emotions to be smaller than the within-day variance (Hypothesis 1b), based on previous studies exploring the day-to-day variance of general life emotions (Hawkey et al., 2007; Nezlek et al., 2008).

RQ2: Does daily autonomous/controlled educational goal motivation predict situational academic emotions?

Based on the SDT (Deci & Ryan, 2000; Sheldon & Elliot, 1999), we hypothesized that students' motivational goals would relate to their academic emotions during study-related activities. In line with research on goal-based behaviour across individuals (e.g., Gillet et al., 2013; Miquelon & Vallerand, 2006; Reis et al., 2000) and previous intra-individual studies on the subjective value as an antecedent of students' positive emotions (Ahmed et al., 2010; Bieg et al., 2013; Goetz et al., 2010), we expected that autonomous motivation would relate to positive activating emotions. Controlled motivation, instead, was expected to be associated with negative activating emotions (Gillet et al., 2013). On the between-day level, this means that if a student reports autonomous educational goal motivation in the morning, more positive emotional experiences could be expected later during the day compared to controlled

motivation, which, in turn, was expected to be associated with negative emotions (Hypothesis 2a).

Regarding the student level (i.e., inter-individual association), we expected that individuals experiencing their educational goals as more autonomous would tend to experience more positive academic emotions across all situations and days than those who perceive their educational goals to be more controlled motivated, and thus would also experience negative academic emotions more often (Hypothesis 2b). In our additional analyses we controlled for the more general affective dispositions of students, namely, life satisfaction and depressive symptoms, since they may be related to emotional experiences in educational settings (e.g., Hirt et al., 1996; Lane et al., 2005) as well as motivation or lack of it (e.g., Judge, Bono, Erez, & Locke, 2005; Sansone & Thoman, 2006). By doing this, we wanted to assure that the possible associations found between students' morning goal motivation and emotional states are not actually explained by individual differences in these more general affective dispositions. For instance, depressive symptoms may not only be related to negative emotions but also color the perception of all daily experiences, including motivation.

2. Method

2.1. Participants and Procedure

The participants were 55 Finnish first-year university students (69% female; mean age = 22.4 years; SD = 3.1). They studied at the University of Jyväskylä (20 psychology majors), the University of Helsinki (15 teacher students majoring in either education or educational psychology), and the Helsinki Metropolitan University of Applied Sciences (20 media engineering majors). Data collection took place using the contextual activity sampling system (CASS) instrument, which is an experience-sampling software program that runs on smartphones (Inkinen et al., 2014; Litmanen et al., 2012; Tolvanen et al., 2011). Before the data collection started, the participants were provided with smartphones as data-collecting

devices and one hour of user training on how to use the CASS software.

During the 14 days of data collection, the participants' phones beeped five times a day as a signal to complete a short questionnaire. There was a fixed sampling schedule (three-hour predefined intervals), with the participants being able to choose their first sampling time in the morning between 7 a.m. and 10 a.m. (i.e., interval-contingent sampling, see Hektner, Schmidt, & Csikszentmihalyi, 2007). The typical daily sampling schedule was a morning questionnaire at 9 a.m., three daytime questionnaires at 12 a.m., 3 p.m., and 6 p.m., and an evening questionnaire at 9 p.m. (not used in this study). The participants were asked to complete the questionnaire immediately after receiving it. For more information about the CASS procedure, see Inkinen et al. (2014).

In this study the assessment procedure resulted in a maximum of 56 completed state questionnaires for each participant (over 14 days with one morning beep and three daytime beeps), or 3,080 questionnaires overall (56 questionnaires per person from 55 participants). The final totals included 2,716 fully or partially completed questionnaires (88.2%). Of those, the average number of completed questionnaires per person was 49.4 (ranging from 29 to 56; median = 51). Before the two-week diary period, the participants responded to a pretest questionnaire assessing their depressive symptoms and life satisfaction (and background information).

2.2. Measures

2.2.1. *Autonomous and controlled motivation*

The morning questionnaire assessed the participants' educational goals and goal motivation. The students reported the three most important goals related to studying/working¹ that they planned to pursue on that day (open-ended question, see Salmela-Aro & Nurmi, 1997). If none were reported, the rest of the morning questionnaire was skipped. From the 697 morning beeps completed in total, 541 (77.6%) included study- or work-related goals. The minimum number of goals required for a given person per day was one (from all of the days, 16.5% included one study-related goal, 44.5% two goals, and 39.0% three goals). The students then reported the extent to which they pursued each goal for three autonomous reasons: "out of pleasure", "out of interest" (intrinsic motivation), and "because it is important to me" (identified motivation); and three controlled reasons: "because someone else wants me to", "because the situation requires it" (extrinsic regulation), and "because I would feel guilty or anxious if I didn't do it" (introjected regulation). All ratings were given on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). Autonomous motivation was calculated as the mean of intrinsic and identified ratings, whereas controlled motivation was calculated as the mean of extrinsic and introjected ratings (Sheldon & Elliot, 1998; see also Vasalampi et al., 2010). Finally, the ratings were averaged across the goals to create overall

¹ Here the Finnish equivalent for the word *working* refers more to study-related activities than doing actual work (e.g., outside the university), and the words studying and working were designed to complement each other in the questionnaires. Since the majority of the answers did include activities particularly related to studying, and since in a few of the cases it was hard to distinguish between these two, we decided to keep all other activities except for those clearly not related to academic/cognitive work (e.g., leisure activities).

measures of day-level autonomous ($mean\ \alpha = 0.85$ across goals, $SD = 1.23$) and controlled goal motivation ($mean\ \alpha = 0.82$, $SD = 1.12$).²

2.2.2. Academic emotions

The daytime questionnaires first asked the participants about their current emotions (i.e., emotional states). After that, the participants described their current activity in an open-ended response. These responses were categorized as consisting of either (a) activities related to studying/working¹ (e.g., reading for an exam, attending class) or (b) other tasks (e.g., watching TV, having lunch). Based on this, a dummy variable was created (0 = non-academic, 1 = academic situations). From the 2,019 daytime beeps completed in total, 884 (43.8%) included academic activities (and emotions), and only academic situations were used in later analyses. All activities were rated in terms of eight emotions using a modified version of the Positive and Negative Affect Schedule (PANAS; based on Watson et al., 1988; see Litmanen et al., 2012). The participants rated “The extent you feel at the moment: ...”: interested, enthusiastic, determined, and active (four emotions measuring a positive activating state), and anxious, nervous, irritable, and stressed (four emotions measuring a negative activating state). All ratings were given on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). Level-specific Cronbach's α for negative activation was 0.71 at the

² Since the students reported up to three different educational goals each morning, the extent to which they pursued each goal for autonomous and controlled reasons also varied across the goals. However, we were interested in the students' general motivational disposition in the morning, and therefore the ratings were averaged across the goals to create overall measures of goal motivation. Furthermore, although fewer study-related goals were reported on weekends (compared to weekdays), the days did not differ statistically in terms of autonomous ($F(6, 540) = 0.208$, $p = 0.974$, $\eta_p^2 = 0.01$) or controlled motivation ($F(6, 540) = 0.535$, $p = 0.782$, $\eta_p^2 = 0.00$).

within-day level, 0.94 at the between-day level, and 0.93 at the between-student level.

Cronbach's α for positive activation was 0.81 at the within-day level and 0.94 at the between-student level (no latent variable was specified on the between-day level, see the Results section).

2.2.3. *Control variables*

Depressive symptoms were measured using a revised version of the short Beck's Depression Inventory (BDI; Beck & Beck, 1972). The participants were asked to rate 13 items (e.g., "I often feel sad") on a 5-point scale ranging from 1 (*I totally disagree*) to 5 (*I totally agree*; see Salmela-Aro & Nurmi, 1996). Life satisfaction was assessed with the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), using five items (e.g., "I am satisfied with my life") on a 6-point scale ranging from 1 (*I totally disagree*) to 6 (*I totally agree*). The Cronbach's alphas for the scales were 0.83 and 0.79 respectively.

2.3. **Statistical analyses**

The data were structured hierarchically into three levels, with situations (i.e., within-day level; $N_{\text{Level 1}} = 884$) nested in days (i.e., between-day level; $N_{\text{Level 2}} = 509$) nested in students (i.e., between-student level; $N_{\text{Level 3}} = 55$). Level one represented the variation of emotional states from one situation to another, and level two included measures of day-specific goal motivation each morning (both intra-individual). We firstly examined descriptive statistics for all variables using an unconditional multilevel model. In order to test Hypotheses 1a and 1b, we also evaluated how much variation in each of the measures could be attributed to situations within days (Level 1), days (Level 2), and students (Level 3). By design, the emotion ratings varied on all three levels, while the goal motivation ratings varied between days and students only, because they were only assessed once per day. In addition, we investigated the correlational structures between emotions on each level. Secondly, in order to test Hypotheses 2a and 2b, we specified two multilevel structural equation models (MSEM; e.g., Marsh et al., 2009) for positive and negative emotions separately, to examine the

predictive value of autonomous and controlled motivation. In order to better control both sampling and measurement error and to test the equivalence of the factor structure across levels, we modelled positive and negative emotions as latent factors (i.e., a doubly latent model, see Marsh et al., 2009; see also Dietrich, Viljaranta, Moeller, & Kracke, 2017; Salmela-Aro, Moeller, Schneider, Spicer, & Lavonen, 2016). We specified the models so that the item loadings were held equal across the three analysis levels.

We evaluated the effects of autonomous and controlled goal motivation on academic emotions both on the between-student level (i.e., inter-individual level) and on the between-day level. Inter-individual analyses determine the relationship between variables *across individuals*. Responses are analysed for variation around the group mean, identifying between-person differences. Intra-individual analyses, on the other hand, determine the relationship between variables *across days within a given person*. Responses are analysed for variation around each individual's mean, rather than a group, thus identifying within-person functioning (see Voelkle, Brose, Schmiedek, & Lindenberger, 2014). At first, the models were estimated without control variables. In the next step we controlled for depressive symptoms and life satisfaction to examine the extent to which these variables affected the findings on the inter-individual level (student level).

In the MSEMs, goal motivation as well as control variables were used as the manifest mean.³ Further, autonomous and controlled motivation, depressive symptoms, and life satisfaction were grand mean centred and correlated with each other in the models. Good model fit was defined as a value below 0.05 on the Root Mean Square Error of Approximation (RMSEA), as a value below 0.08 for the Standardized Root Mean Square Residual (SRMR_{BS} for between student, SRMR_{BD} for between day, and SRMR_W for within

³ MSEMs would have had too many parameters (leading to nonidentification of the model) if both goal motivation and emotions had been modelled as latent constructs.

parts, respectively), and as a value above 0.95 on the Comparative Fit Index (CFI; see, for example, Hu & Bentler, 1999). In all models, a robust maximum likelihood (MLR) estimator was used to adjust standard errors for non-normality in the indicators, and missing data was estimated using the full-information maximum likelihood procedure in Mplus 7.4 (Muthén & Muthén, 2012).

3. Results

3.1. Descriptive statistics

Table 1 presents the means and variances of all items on each level. Overall, the participants chose their educational goals more often for autonomous than for controlled reasons.

Moreover, negative emotions were less pronounced than positive emotions in the participants' daily study activities. Table 2 shows the correlations between emotion items on all three levels and between emotions and morning goal motivation scores on Levels 2 and 3. In general, emotions of the same valence were clearly associated across all levels, although these correlations were smaller at the situation level (within-day level) than at the between-day or between-student level. Moreover, while negative emotions correlated invariantly across all three levels, some of the correlations between positive emotions showed differences across the three levels. Interest and determination, for instance, were correlated across situations and across individuals, but the correlation was low across days. The emotions of different valence were mostly unrelated across all levels, or the associations were rather weak (see Table 2).

Finally, the low correlations between autonomous and controlled motivation on both Levels 2 and 3 indicates that both constructs seemed to occur rather independently across days and across individuals.

Table 1

Means, intraclass correlations (ICCs) and variance components for academic emotions and goal motivation.

Item	<i>M</i>	<i>ICCs</i>		<i>Variances</i>		
		L2	L3	L1	L2	L3
Interest	4.30	0.03	0.25	1.77	0.07	0.61
Enthusiasm	3.79	0.07	0.25	1.68	0.16	0.61
Determination	4.12	0.09	0.36	1.30	0.21	0.84
Activeness	3.77	0.09	0.32	1.26	0.18	0.67
Anxiety	2.02	0.15	0.43	0.77	0.26	0.79
Nervousness	1.78	0.13	0.35	0.72	0.17	0.48
Irritation	1.83	0.08	0.25	1.03	0.12	0.39
Stress	2.24	0.11	0.44	0.93	0.23	0.90
Autonomous motivation	4.15	--	0.63	--	0.57	0.96
Controlled motivation	3.82	--	0.66	--	0.44	0.85

Note: All items were rated on a scale from 1 = *not at all* to 7 = *very much*. Means are based on manifest variables and averaged across all students and daily reports. L1 = situation level. L2 = day level. L3 = student level. ICC on L2 = percentage of variance on Level 2 relative to L1 and L3. ICC on L3 = percentage of variance on Level 3 relative to L1 and L2.

Table 2

Within- and between-person correlations of academic emotions and goal motivation.

Item	1	2	3	4	5	6	7	8	9	10
<i>L1: Situation level</i>										
1 Interest	1									
2 Enthusiasm	.66	1								
3 Determination	.55	.44	1							
4 Activeness	.50	.55	.37	1						
5 Anxiety	-.16	-.20	-.06	-.23	1					
6 Nervousness	-.09	-.18	.04	-.14	.41	1				
7 Irritation	-.32	-.34	-.12	-.31	.28	.41	1			
8 Stress	-.28	-.32	-.08	-.30	.32	.43	.42	1		
<i>L2: Day level</i>										
1 Interest	1									
2 Enthusiasm	.60	1								
3 Determination	.21	.40	1							
4 Activeness	.39	.86	.72	1						
5 Anxiety	-.17	-.34	.11	-.29	1					
6 Nervousness	-.38	-.30	-.23	-.33	.71	1				
7 Irritation	-.13	-.24	-.13	-.29	.85	.82	1			
8 Stress	-.16	-.24	-.07	-.28	.88	.71	.83	1		
9 Autonomous G.	.56	.40	.24	.27	-.10	-.17	-.25	-.26	1	
10 Controlled G.	.14	.03	.22	.05	.28	.22	.20	.25	-.08	1
<i>L3: Student level</i>										
1 Interest	1									
2 Enthusiasm	.90	1								
3 Determination	.76	.72	1							
4 Activeness	.75	.93	.76	1						
5 Anxiety	-.26	-.27	.13	-.12	1					
6 Nervousness	-.36	-.30	-.18	-.18	.78	1				
7 Irritation	-.27	-.27	-.05	-.18	.78	.84	1			
8 Stress	-.28	-.35	-.13	-.34	.83	.83	.77	1		
9 Autonomous G.	.65	.74	.55	.71	.16	.05	.04	.02	1	
10 Controlled G.	-.07	.07	.02	.03	.24	.39	.38	.26	.02	1

Note: G. = Goal motivation.

3.2. RQ1: Variability in academic emotions

Table 1 provides the intraclass correlations of state emotions (on Levels 2 and 3) and morning goal motivation scores (only on Level 3). Since the ICCs on Level 2 express the relative percentage of how much of the total variation in emotions is (only) between days (not due to situations or persons), and on Level 3 (only) between individuals (not due to situations or days), the percentage of the variation that is left from the total variance refers to pure

situational fluctuation (excluding cross-day and cross-person variations). Findings showed that 3–15% of the variance in emotions was due to day (Level 2), and 25–44% due to differences between students (Level 3). Particularly large were the Level 3 ICCs for anxiety and stress. When the between-day variation was also taken into account, less than 50% of the variation in anxiety and stress was left to be explained by the situation. However, regarding the majority of the emotions, especially interest, the largest portion of variance was located at the situation level, supporting Hypotheses 1a and 1b.

3.3. RQ2: Educational goal motivation and academic emotions

Before testing our hypotheses, we used multilevel confirmatory factor analyses to test latent factors of positive and negative emotions. Although the factors were expected, they were not supported on all levels. Since the items measuring positive emotions were in part weakly correlated on the between-day level (Level 2) and since constructing a latent factor of positive emotions on Level 2 resulted in a bad model fit, we kept positive emotions as separate manifest items on that level. Otherwise, positive emotions were modelled as one latent factor with equal loadings across Levels 1 and 3 (see Figure 1). In addition, since the residual variance of ‘enthusiastic’ was slightly negative on Level 3, we fixed this variance to be zero in the final model. Negative emotions were modelled as a latent factor with invariant item loadings on all three levels (see Figure 2).

Figure 1 presents the regression parameters of the MSEM regressing positive emotions on goal motivation and Figure 2 the regression parameters of the MSEM regressing negative emotions on goal motivation.⁴ On the between-day level (Level 2), higher autonomous goal motivation positively predicted all positive emotions ($\beta = 0.26 - 0.16$; $p = 0.002 - 0.030$), while controlled goal motivation predicted negative emotions ($\beta = 0.14$; $p = 0.007$). Interestingly, higher controlled motivation was also associated with one of the positive emotions, namely determination ($\beta = 0.16$; $p = 0.019$). These results support Hypothesis 2a and indicate that the goal motivation in the morning predicts academic emotions later during the day. Findings on the between-student level (Level 3) mirrored the between-day level results (coefficients presented in parentheses in Figures 1 and 2). This suggests that the students who tended to set more autonomously motivated goals than their peers also experienced positive emotions more often on average across all situations and days ($\beta = 0.59$; $p < 0.001$). On the other hand, the students who reported more often controlled-motivated goals than their peers also tended to experience higher levels of negative emotions ($\beta = 0.26$; $p = 0.027$; Hypothesis 2b).

⁴ The model fits for both positive and negative emotions were acceptable (positive emotions: $\chi^2 = 43.53$, $df = 14$, $p = 0.00$, CFI = 0.97, RMSEA = 0.05, SRMR_W = 0.02, SRMR_{BD} = 0.11, SRMR_{BS} = 0.07; negative emotions: $\chi^2 = 27.83$, $df = 24$, $p = 0.32$, CFI = 0.99, RMSEA = 0.01, SRMR_W = 0.03, SRMR_{BD} = 0.05, SRMR_{BS} = 0.05).

Factor loadings were statistically significant and the reliabilities (R^2) were substantial for negative emotions on all levels and for positive emotions on Levels 1 and 3.

Finally, we examined whether controlling for depressive symptoms and life satisfaction affected the findings on the student level (coefficients marked in bold in Figures 1 and 2). In these additional models,⁵ depressive symptoms were related to more negative ($\beta = 0.40$; $p = 0.005$) and fewer positive emotions ($\beta = -0.26$; $p = 0.034$). Reciprocally, life satisfaction was associated with more positive ($\beta = 0.29$, $p = 0.005$) and fewer negative emotions ($\beta = -0.38$, $p = 0.006$). Furthermore, depressive symptoms were positively related to controlled motivation ($\beta = 0.63$, $p = 0.006$). After the effect of depressive symptoms was included into the primary models, the predictive impact of controlled motivation on negative emotions was no longer statistically significant. However, adding the control variables did not change the predictive impact of autonomous motivation on positive emotions on the student level.⁶

⁵ Model fit for the additional model with positive emotions was $\chi^2 = 50.48$, $df = 20$, $p = 0.00$, CFI = 0.97, RMSEA = 0.04, SRMR_W = 0.02, SRMR_{BD} = 0.09, SRMR_{BS} = 0.06. Model fit for the additional model with negative emotions was $\chi^2 = 33.07$, $df = 30$, $p = 0.32$, CFI = 0.99, RMSEA = 0.01, SRMR_W = 0.02, SRMR_{BD} = 0.04, SRMR_{BS} = 0.04.

⁶ We also specified MSEMs which included gender and discipline as covariates (positive emotions: $\chi^2 = 78.95$, $df = 35$, $p = 0.00$, CFI = 0.96, RMSEA = 0.04, SRMR_W = 0.01, SRMR_{BD} = 0.07, SRMR_{BS} = 0.07; negative emotions: $\chi^2 = 65.88$, $df = 45$, $p = 0.02$, CFI = 0.97, RMSEA = 0.02, SRMR_W = 0.02, SRMR_{BD} = 0.03, SRMR_{BS} = 0.08). Gender and discipline were unrelated to a student's general tendency to experience positive and negative emotions and autonomous motivation. Furthermore, although teacher students ($\beta = 0.66$; $p = 0.03$ and $\beta = 0.66$; $p = 0.03$) and media engineering students ($\beta = 0.74$; $p = 0.02$ and $\beta = 0.76$; $p = 0.02$) reported more controlled motivation in both models (psychology students as a reference group; Wald test of the differences), adding the control variables did not change the predictive impact of other variables on emotions on the student level (as presented in Fig. 1 and 2).

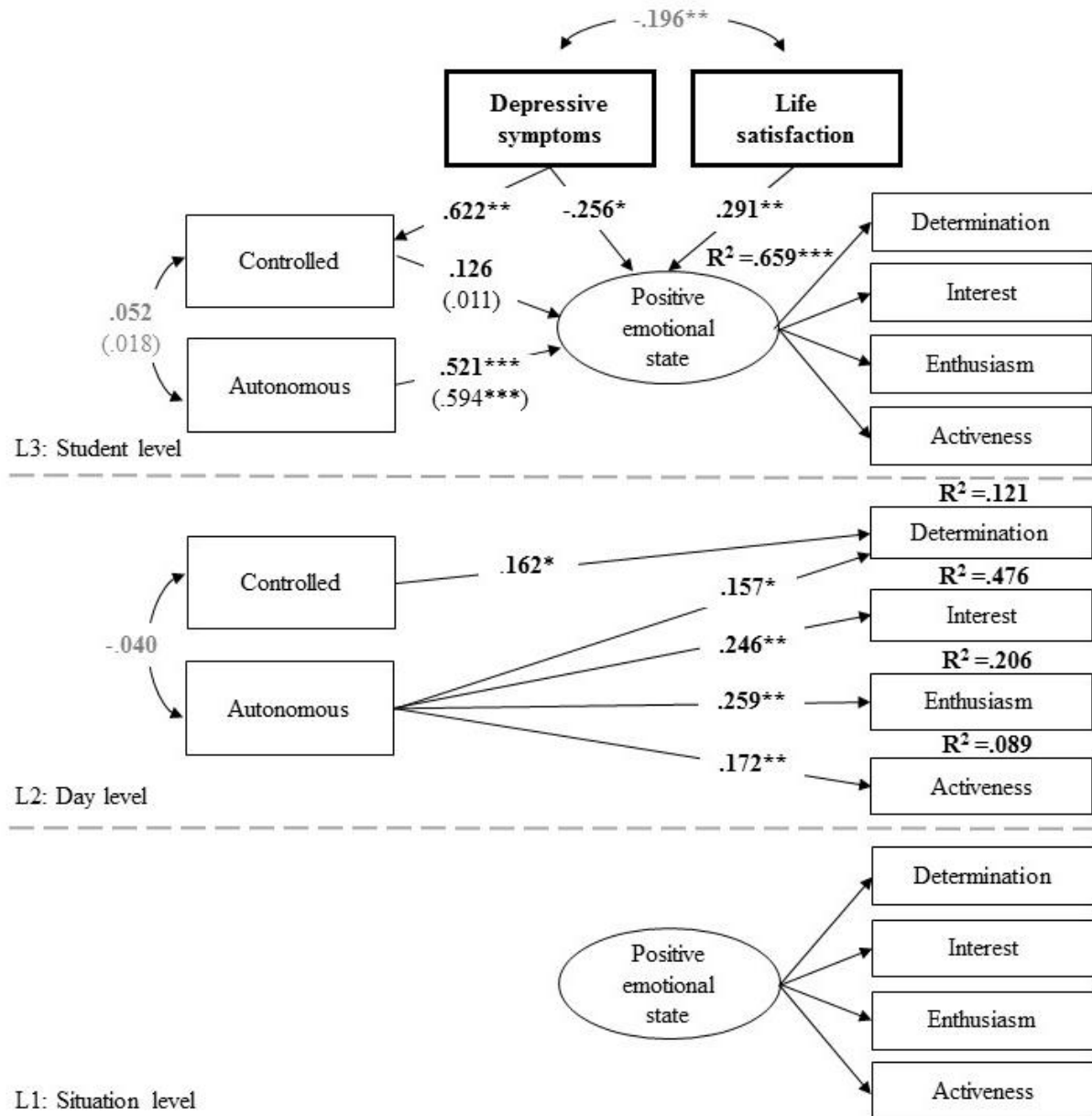


Fig. 1. The students' autonomous and controlled goal motivation predicting positive academic emotions.

Note: Positive emotions loaded on one latent variable on Levels 1 and 3, but were represented by distinct manifest items on Level 2. Autonomous and controlled motivation, depressive symptoms, and life satisfaction were grand mean centred and correlated with each other in both models. For the sake of clarity, only the significant paths are shown on the day level (L2) and for the control variables, although all paths were tested. Unstandardized coefficients presented. $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

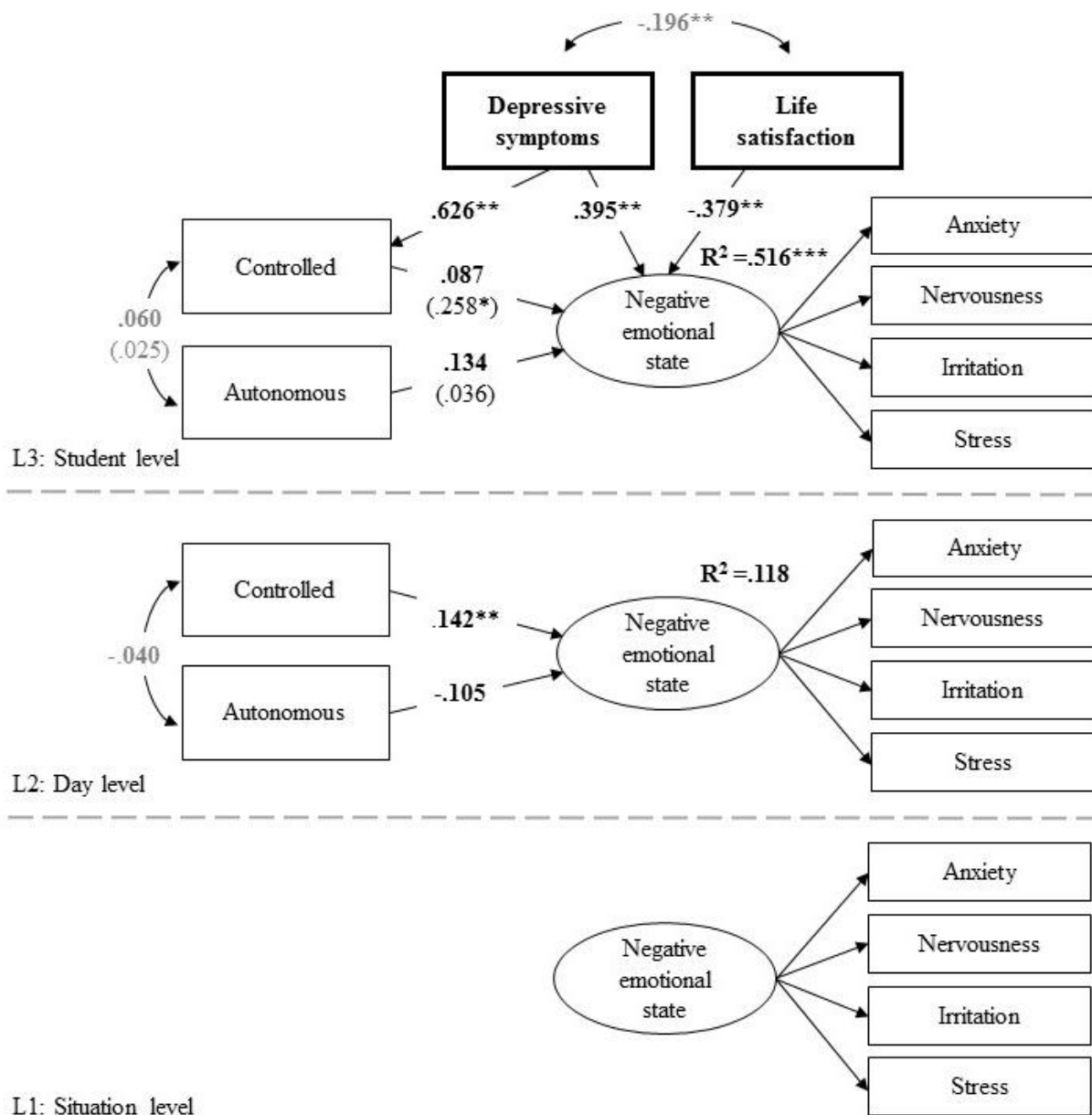


Fig. 2. The students' autonomous and controlled goal motivation predicting negative academic emotions.

Note: Autonomous and controlled motivation, depressive symptoms, and life satisfaction were grand mean centred and correlated with each other in both models. For the sake of clarity, only the significant paths are shown for the control variables, although all paths were tested. Unstandardized coefficients presented. $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

4. Discussion

In the present study we examined the relationship between university students' daily academic goal pursuit and their emotional experience. First, we investigated the extent to which university students' academic emotions varied from one situation to another and from one day to another over two weeks of studying. Second, following SDT and a personal goal framework, we examined how the pursuit of short-term autonomous and controlled-motivated educational goals predicted academic emotional states.

4.1. Variability in academic emotions

The largest portion of variance in academic emotions was located at the situation level, especially compared to the between-day level, in line with Hypotheses 1a and 1b. This finding is consistent with those of Hawkley et al. (2007) and Nezlek et al. (2008), who found that intra-individual fluctuation in non-academic emotions was much stronger *within* a given day than *between* days. However, our study indicated that academic emotions experienced during study-related activities (e.g., interest, enthusiasm, irritation) are also rather more situation driven than day dependent. Likewise, in our study, the variances located at the between-student level were mainly smaller than at the situation level, which is in accordance with other recent work involving academic emotions (Goetz et al., 2016, Nett et al., 2011).

Besides these overall similarities, some slight differences appeared between specific emotions. For instance, there was more variation between situations for interest than for anxiety and stress (see Table 1, Wald tests of the differences $p_{anxiety} = 0.002$; $p_{stress} = 0.004$). Less than 50% of the variation in anxiety and stress was due to changes between situations after both the between-day and inter-individual variations were taken into account. Consequently, more person-level variation was observed for anxiety ($ICC_{L3} = 0.43$) and stress ($ICC_{L3} = 0.44$) than for interest ($ICC_{L3} = 0.25$; Wald tests of the differences $p_{anxiety} = 0.050$; $p_{stress} = 0.032$), and more variation also was seen between days for anxiety ($ICC_{L2} = 0.15$) than for interest ($ICC_{L2} = 0.03$; Wald test of the difference $p = 0.026$). Thus, although substantial

ICCs of both positive and negative emotions on Level 3 indicate that inter-individual differences influence a person's tendency to experience positive and negative academic emotions across all situations and days, the anxiety and stress experienced during study-related activities might be more strongly affected by personality dimensions (such as neuroticism; see e.g., Diener, Oishi, & Lucas, 2003) in addition to the given academic situation. Experienced interest during studying, on the other hand, seems to be much less driven by personal tendencies or the day. This is also in accordance with previous studies that emphasized the state-level determinants of situational interest (e.g., Tanaka & Murayama, 2014), but the person-level determinants of situational anxiety (e.g., Moeller et al., 2015; Pekrun et al., 2002).

Furthermore, the unidimensional factor structure of negative activating emotions was invariant across the three levels. Thus, besides within situations (and persons), negative academic emotions tend to be blended within a day, meaning that on “bad days”, a bad emotion is probably soon joined by other bad feelings. This suggests that days can also be characterized by *negative affectivity* (see Watson & Clark, 1992). In contrast, positive emotions were strongly correlated with each other across situations and individuals (forming one latent factor on these levels), but they were more separate and independent experiences on the between-day level (for the divergent structures of emotions at different levels of analysis, see also Schmukle et al., 2002; Vansteelandt et al., 2005). This supports a more discrete model of positive emotions within a day (see Zelenski & Larsen, 2000). In other words, feeling determined, for instance, on one day does not necessarily mean that the individual is also feeling enthusiastic on that particular day.

4.2. Relations between autonomous and controlled motivation and academic emotions

Our findings indicate that the principles of SDT (Deci & Ryan, 2000; Sheldon & Elliot, 1999) operate also for the short-range educational goals that students set every day. We found that setting autonomous educational goals was associated with more positive emotions and setting

controlled goals with more negative emotions. The higher the autonomous motivation was in the morning, the higher were the positive activating emotions during the course of the day, which supports Hypothesis 2a. Moreover, the higher the controlled motivation was in the morning, the higher were the negative activating emotions during the day.

However, both autonomous and controlled goal motivation was associated with determination in students' daily lives. This is in line with previous studies showing that controlled-motivated goals might also have positive effects, for instance, resulting in somewhat higher persistence over the short term than a no-goal condition (Vansteenkiste et al., 2006). In addition, controlled motivation is likely to prompt some type of participation and engagement in learning, yet such participation is not necessarily intrinsic (Vansteenkiste, Simons, Soenens, & Lens, 2004). In other words, a student may be determined and active, yet not be fully interested in or enthusiastic about the current study task if it comes with a perceived obligation and a sense of pressure. Thus, conceptually, two classes of positive activating emotions seem to emerge, that is, those that come with a more behavioural aspect of engagement (e.g., determination) and those that refer more to an emotional aspect of engagement (e.g., enthusiasm; see Fredricks, Blumenfeld, & Paris, 2004; Skinner, Furrer, Marchand, & Kindermann, 2008). This, and the fact that controlled motivation was related to determination, may also explain why the four positive emotions did not load on the same factor in the present study.

Finally, findings on the between-student level partly supported Hypothesis 2b: students who on average perceived their daily educational goals as autonomously motivated also tended to experience positive emotions more often, across all situations and days. On the other hand, controlled motivation was related to negative academic emotions on the student level in the model without the control variables (see also Gillet et al., 2013). However, in the additional model both controlled motivation and negative emotions were substantially correlated with depressive symptoms, and after controlling for depressive symptoms, the

person-level association between controlled motivation and negative emotions vanished.

Thus, the relation between controlled motivation and negative emotions, also suggested by previous research (see Gillet et al., 2013), might be actually explained by a more stable affective disposition, such as depressive symptoms. However, since depressive symptoms overlap somewhat with negative emotions, our finding does not imply that no association exists between negative emotions and controlled motivation on the student level, but rather that this association was not incrementally large after depressive symptoms were taken into account. Furthermore, it could be claimed that controlling for depressive symptoms is overly conservative here, as negative emotions are even a critical criterion to diagnose depression. Thus, we cannot directly expect controlled motivation to yield a supplementary effect above and beyond depressive symptoms, since depression is such an overwhelming disposition. Indeed, being depressed was related to both controlled goal setting and negative emotions across the two-week period. Finally, although not directly tied to a specific academic activity, the trait measures of life satisfaction and depressive symptoms were related to both positive and negative emotional experiences in academic settings.

4.3. Methodological reflections and future directions

The present study has several strengths, in particular, the assessment of students' emotions in the moment in which they occur. Nevertheless, the present study has its own limitations which have implications for future research. First, concerning the research design, the sample consisted of mostly females, and only three academic fields were included. The data were collected across only 14 days, which also limits the possible conclusions and generalizations, because goal setting and emotions may change over the course of an academic year, and we did not capture all of this variety. Moreover, using fixed beeping schedules in the ESM assessments instead of randomized timing may have increased anticipatory thoughts and consequently changed behaviours (Bolger, Davis, & Rafaeli, 2003).

Second, we only used the short version of the PANAS, but recognize that different emotion frameworks exist. It would be interesting to include, for instance, deactivating emotions such as *boredom* (see Pekrun et al., 2010). Additional data sources such as physiological indicators and behavioural observation (e.g., facial expression) could also be used to complement self-report data in order to reduce biases related to self-reports and common methods.

Third, it might be argued that the day level did not contribute much insight, given that the between-day variance explained relatively little of the total variance in emotions (3–15%). However, since we know of no other study distinguishing day-to-day changes in academic emotions from other sources of variance, we deemed it necessary to report the significance of the day-level variation. Moreover, including the variation between days as an additional level revealed new insights about the structure of emotions (see above). However, using three levels left us with a rather small within-day sample size (three time points within a day), and interpretations are therefore to be made with caution.

Fourth, since the autonomous and controlled motivation scales were limited to three items, not all of the subcomponents of autonomous and controlled motivation were properly disentangled (the intrinsic motivation and extrinsic regulation subtypes dominated the constructs). As a result, the observed correlates of controlled and autonomous motivation could be partly due to intrinsic and extrinsic regulation subtypes as opposed to identified and introjected subtypes. In addition, the aggregation of motivation scores across up to three different goals within a day might have masked some effects. Despite these aggregations, we found clear associations between morning goal motivation and academic emotions in the same days and individuals. However, our data do not allow us to make inferences about the causality between goal motivation and academic emotions. Reverse or bidirectional explanations are possible, particularly considering the strong correlations among the constructs. Furthermore, relations between variables may be affected by tertiary variables,

such as depressive symptoms, as we observed on the between-student level. For instance, if a student experiences no personal relevance in his or her studies (see Ketonen et al., 2016), then stronger negative emotions might result from controlled goal motivation.

Finally, in addition to morning goal motivation, it would be interesting to examine motivation for activity engagement during the day to predict within-day variation in emotions, that is, the source of motivation that arises in the process of goal pursuit. Furthermore, the same goals may be pursued for autonomous and controlled reasons at the same time (e.g., Ratelle, Guay, Vallerand, Larose, & Senécal, 2007), and positive and negative emotions often co-occur in learning situations and students (Moeller et al., 2015; Moeller, Ivcevic, Brackett, & White, 2017; Pekrun et al., 2002). Detecting such intra-individual co-occurrences requires different methods, such as latent profile analysis or co-occurrence network analysis, and opens an interesting avenue for future ESM studies.

4.4. Implications for education

Detecting the antecedents of academic emotions is important since previous research indicates that academic emotions not only affect students' motivation and academic success, but are also core elements of students' psychological health and well-being, and thus, important educational outcomes on their own (Pekrun 2016). The strong variation in academic emotions across learning situations suggests that the characteristics of learning situations may have a strong impact on emotional experiences, and that this influence can be used by teachers for the purpose of eliciting optimal emotions about learning contents. Positive activating emotions especially vary by situation. Thus, every learning situation matters, and the instruction should be designed accordingly (e.g., Lonka & Ketonen, 2012).

In addition to the impact of the given moment, we suggest that enhancing the pursuit of autonomous educational goals fosters adaptive academic emotions, as proposed by previous literature on the benefits associated with engagement in daily need-satisfying activities (i.e., the experience of satisfaction in the basic psychological needs for autonomy,

competence, and relatedness; Deci & Ryan, 2000). Furthermore, it seems that both autonomous and controlled-motivated educational goals are associated with determination in students' daily lives. Since determination (i.e., *effort regulation*) is assumed to promote goal achievement and improve performance (e.g., Pintrich, 2004), we conclude that teaching students to set educational goals in the mornings might benefit their learning overall. Indeed, it seems that also controlled-motivated students display some degree of effort (determination) during the day, yet may pay an emotional price for it, as indexed by simultaneous negative emotions. Since controlled goals are frequent (even in self-determined goal setting), another intervention could target the coping strategies of dealing with these goals, for example, by addressing the control appraisals that may make the difference between negative and positive emotional outcomes (e.g., Ruthig, Perry, Hall, & Hladkyj, 2004). Emphasizing the likeable and intrinsic aspects of tasks that are "required by the situation" may also lead to more positive and fewer negative emotions. Overall, to develop and justify such interventions, it is crucial to know that the expected relations between academic goal setting and emotions are malleable and hold at the intra-individual level (Voelkle et al., 2014), which is what our study has shown.

The present study implies that the principles of SDT (Deci & Ryan, 2000) operate not only for mid- and long-term personal goals, but also for the short-range educational goals that students set every day. Extending previous research on the role of autonomous motivation in students' general well-being (e.g., Miquelon & Vallerand, 2006), the present study suggests that short-term educational goal pursuit and autonomous goals set in the mornings promote students' positive emotional experiences while studying. Interventions fostering autonomous educational goal setting (e.g., Reeve, Jang, Carrell, Barch, & Jeon, 2004; Salmela-Aro et al., 2010; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004) could therefore not only benefit the self-regulation process, but might also increase positive emotions in students' daily lives.

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